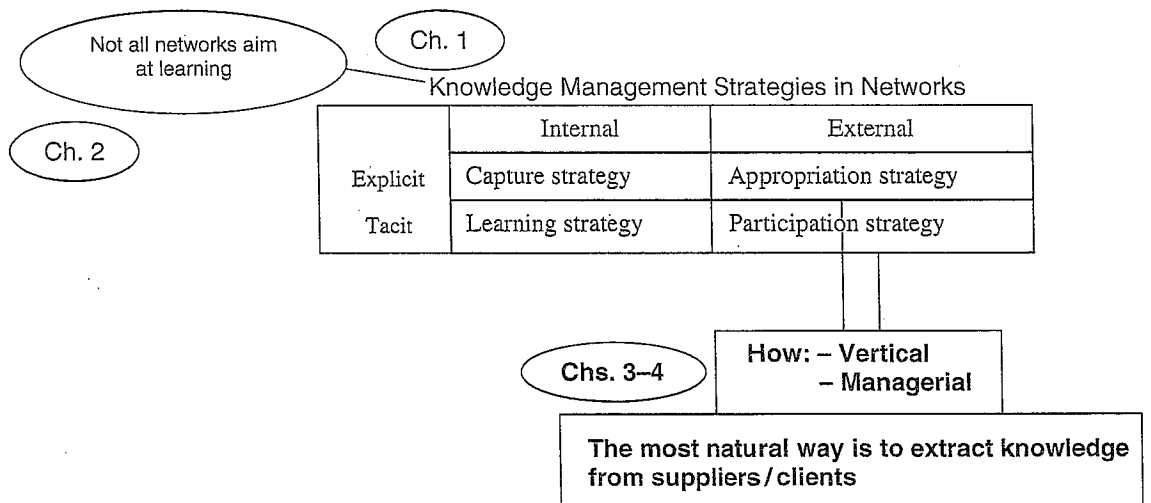


# On the Challenges of Buyer–Supplier Collaboration in Product Development Projects

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## Abstract

Integrating key suppliers with superior technological knowledge into a buyer's product development projects has long been discussed as a mutually value-creating strategy. However, empirical evidence shows that such supplier involvement often impedes project performance in terms of quality, budget, and time. This chapter focuses on the difficulties faced by companies engaged in interorganizational collaborative product development projects. Our analysis highlights issues at the organizational level (e.g., each partner aiming to maximize transaction value) and the project level (e.g., collaborating on a project staffed by members of different organizations with different identities, cultures, goal structures, etc.). We conclude by offering suggestions on how to deal with these challenges and pointing to necessary further research in this area.

## Introduction

It is widely accepted that firms' boundary decisions and the alignment between the firms' governance structures and exchange characteristics have far-reaching implications on firm performance (Leiblein et al., 2002; Teece, 1996). Firms may particularly benefit from the utilization of specialized competencies residing outside their boundaries (Dyer and Nobeoka, 2000; Dyer and Ouchi, 1993; Mowery et al., 1996). Therefore, firms no longer limit their outsourcing approaches to manufacturing and service tasks (Quinn, 2000; Quinn and Hilmer, 1994; Venkatesan, 1992), but increasingly extend new product development (NPD) activities and integrate internal company resources with those of other supply chain members: customers and, increasingly, suppliers (Fritsch and Lukas, 2001; Rogers et al., 2004; Roy et al., 2004; see also Box 4.1, executive interview question 1). The so-called early supplier involvement strategy aims at capitalizing on the specific expertise of advanced suppliers by soliciting their services not only for production of parts and components, but also for their design and development (Clark and Fujimoto, 1991; O'Neal, 1993; Wagner, 2003).

Corporate practitioners and numerous scholars have argued that buyers can benefit from involving suppliers in the development process rather than working independently when it comes to time-to-market of new products, product quality, development cost, and product cost, and that such a strategy can also help firms conserve resources, share risks, gain new competencies, and move faster into new markets (Birou and Fawcett, 1994; Bonaccorsi and Lipparini, 1994; Bozdogan et al., 1998; Clark, 1989; Dröge et al., 2000; Handfield et al., 1999; Ragatz et al., 1997; Wagner and Johnson, 2004; see also Box 4.1, executive interview question 2).

### Box 4.1 Executive interview with Professor Dr.-Ing. Raimund Klinkner

#### *Profile:* GILDEMEISTER AG

GILDEMEISTER is one of the major manufacturers of metal cutting machine tools worldwide. Its range of products includes turning and milling technologies along with trend-setting "ultrasonic" and "laser" technologies. Its customers can rely on top quality, proficient technical services and state-of-the-art software products all from a single producer. GILDEMEISTER has its headquarters in Bielefeld, Germany.

#### *Profile:* Professor Dr.-Ing. Raimund Klinkner

Professor Dr.-Ing. Raimund Klinkner is Deputy Chairman of the Executive Board. His area of responsibility includes production and logistics. Furthermore, he is Honorary Professor of Production Logistics at Berlin Technical University. Before he joined GILDEMEISTER, Professor Dr.-Ing. Klinkner worked in the car industry.

*Question 1:* Professor Klinkner, over the past decade many industrial firms have outsourced assembly, production and increasingly R&D responsibilities to their suppliers. Did this occur at GILDEMEISTER as well? And if so, what urged you to outsource?

Continued.

**Box 4.1** Continued.

*Answer:* Indeed, at GILDEMEISTER the degree of outsourcing has increased considerably in recent years – in the same way it did in the automotive industry a few years ago. The major drivers behind this development include more demanding global customers, a shorter time-to-market, and the fast technological developments in our industry, coupled with our goal to remain a global market leader. This encouraged us to focus even more on our core competencies and to align our supply chains with our specialist and competent suppliers.

As a consequence, our supplier base had to take over more and more assembly and manufacturing capacity and responsibility for components and modules. For example, the production of control cabinets and chip conveyors was no longer considered a core area of expertise of GILDEMEISTER, therefore, we decided to buy these modules from suppliers specializing in the development and production of control cabinets and chip conveyors. Furthermore, our “modular logistics concept” urges suppliers to take over logistical responsibilities, such as setting up, planning, and running transshipment points in our plants for the components and modules they deliver to us.

We carefully evaluate what we outsource and where we outsource. For example, we successfully assemble most of the standard machines in low-cost countries with local content from local suppliers. Because of the high degree of engineering required for customer-specific machines, we prefer to manufacture these customer-specific machines in Germany. We also pay close attention to our suppliers' capabilities. While we try to partner only with the best suppliers in each technology, we still follow a dual-sourcing strategy, that is, if a supplier fails to satisfy our requirements, we have a backup source. A professional supplier management is vital.

*Question 2:* Your company is renowned for offering trend-setting solutions, for example three-dimensional laser beam machining. Also, over 90 percent of GILDEMEISTER's current delivery programme consists of machines that were developed during the past three years. How important are suppliers if GILDEMEISTER wants to remain an innovation leader?

*Answer:* We can only be an innovation leader if our entire supply chain supports our efforts in this direction. If our suppliers were not innovation leaders, we couldn't be either. For example, laser head is key for the functioning of our three-dimensional laser beam machines. This high technology we buy from a specialized supplier. At GILDEMEISTER we encourage our suppliers to come up with innovative products, share their latest developments with us, and engage in joint R&D projects. In return we offer them the opportunity to participate in the success of our machines in the market.

*Question 3:* Many industrial firms have had positive but also negative experiences with selecting and integrating suppliers in product development in terms of product functionality, product quality, development time and development cost, for example. What are the key issues GILDEMEISTER pays close attention to when suppliers are involved in the development of new products?

*Answer:* As a consequence of a reduced manufacturing penetration we increasingly have to integrate suppliers into our product development activities. For example, GILDEMEISTER and

**Box 4.1** Continued.

its suppliers strive to develop standardized components that can be integrated into a large number of machine types. This helps to reduce material and manufacturing costs.

At GILDEMEISTER we have learned that integrating suppliers is inherently difficult due to the uncertainty, risk, and necessary investments associated with new joint developments. This is where a professional and reliable supplier management comes in again: Firstly, our supplier portal "coSupply" ([www.cosupply.de](http://www.cosupply.de)) helps us with everyday communication with suppliers and to transfer information to suppliers in a coordinated manner. Suppliers can also obtain general information and can call up their specific and evaluated performance ratios. With coSupply GILDEMEISTER coaches and coordinates its suppliers in order to develop highly efficient supply partnerships. The supplier portal is characterized by the three performance features: communication, cooperation, and competence. The adoption of these will lead, over a process of constant review and change, to the further optimization of our higher aim, that of competitiveness. All processes serve to improve the competitiveness of our products and thus safeguard our business and the businesses of our suppliers. Secondly, the implementation of long-term "win-win" partnerships and cooperation is crucial.

*Question 4:* Supplier involvement must be managed at a "strategic level" as well as at a "human level," that is, people from two different organizations work together on highly complex and often sensitive tasks. How important are "soft facts" for a successful outcome when your engineers work with supplier engineers in joint R&D projects?

*Answer:* GILDEMEISTER has a hybrid R&D organization, that is, there are centralized R&D resources at headquarters and decentralized R&D resources in the manufacturing plants. Central R&D manages the strategic level and is responsible for R&D strategy, standardization, and coordination of all R&D activities. The decentralized units are responsible for the operative implementation of the strategy. They also work with suppliers. When our engineers work with engineers from supplier firms, we are careful that the suppliers have the same working philosophy as GILDEMEISTER and if possible the same CAD system. We also encourage a culture of open discussion and the use of compatible working methods.

*Question 5:* How do you see the future for working with suppliers in product development at the GILDEMEISTER group?

*Answer:* We intend to further streamline our supplier base, reduce the number of suppliers we work with, and access the most innovative suppliers' know-how. At the same time we are aware that we have to intensify our R&D partnerships with suppliers. Selected suppliers will be given access to GILDEMEISTER's CAD system. Some suppliers will be given defined work packages and we will evaluate the progress of the supplier's development in joint "design reviews." In contrast, with other suppliers we will work in an integrative manner, that is, we will work with them in the concept phase of a new machine and jointly develop new technical solutions with them.

Professor Klinkner, I thank you for this short interview on such a contemporary topic.

(The interview was conducted by Stephan M. Wagner)

Other studies, however, repeatedly found no positive relationships or even showed negative effects, that is, more supplier involvement leading to increased product and development cost, worse product performance, and longer development times (Eisenhardt and Tabrizi, 1995; Hartley et al., 1997; Littler et al., 1998; Tukul and Wasti, 2001; von Corswant and Tunälvy, 2002; Wynstra et al., 2001).

As a consequence, it seems that supplier involvement in NPD requires that the customer firm is able to cope with such a strategy's inherent challenges on the organizational and the project level (see also Box 4.1, executive interview question 3). Previous research has mainly focused on the organizational level and resulted in the aforementioned mixed results. For better results, successful industrial firms have tried to optimize not only on the organizational level, but to reinforce the "soft facts" and the "human level" as well (see also Box 4.1, executive interview question 4). Correspondingly, a few publications have pointed out that the positive effects of supplier involvement are not easily achieved in product development processes on the project level, where human beings from both organizations interact (Ragatz et al., 1997; von Corswant and Tunälvy, 2002; Wynstra et al., 2001). Three recent publications have specifically taken a project level perspective and highlighted the quality of buyer-supplier collaboration as a key success factor to the successful implementation of supplier involvement in product development projects (Gerwin, 2004; Gerwin and Ferris, 2004; Hoegl and Wagner, 2005). In Gerwin and Ferris's (2004) conceptual investigation of various project organizational options the authors suggest that the preferred option of firms working either independently or with partners in NPD projects depends on the newness of the NPD alliance, the cooperativeness of the alliance in the past, and the distribution of skills among the partners. Gerwin's (2004) theoretical model emphasizes the importance of reducing the coordination gap in joint NPD projects. Mismatches between the required and actual coordination of tasks negatively influence the performance of a NPD project. In their empirical study of product development projects, Hoegl and Wagner (2005) point out that it is important to conceptualize the quality of buyer-supplier collaboration on the project level of analysis, as project members from both organizations are living the relationship between the buyer and the supplier and that the interactions within the project shape the interorganizational exchange and thus are critical in determining its outcomes. The quality of buyer-supplier collaboration is characterized by an open sharing of information, mutual support and accommodation, and high project commitment. The study revealed that an increase in the supplier's share of the project was in itself not significantly related to project success. Rather, the quality of the collaborative working between the buyer's and the supplier's project members was key in explaining project success (Hoegl and Wagner, 2005).

We take this state of the literature and research on supplier involvement in product development as our point of departure and further investigate the challenges companies are facing when suppliers are involved in NPD projects.

It should be noted that the supplier involvement strategy, as defined here, differs from the strategy of creating a modular product architecture with clearly defined technical interfaces between product modules, followed by the external sourcing of modules (Sanchez and Mahoney, 1996; Worren et al., 2002). This strategy, while also ultimately including suppliers for both development and production of modules,

is aimed at reducing the amount of coordination required between the supplier(s) and the buyer. Rather, this chapter pertains to integrative product development with supplier involvement, where the aim is to create value by combining the expertise of the buyer and the supplier firm to develop an integrated and comprehensive, rather than modular, product (Boutellier and Wagner, 2003; see also Box 4.1, executive interview question 5).

As this chapter investigates project-level collaboration nested in interorganizational relationships, the challenges of buyer–supplier collaboration in product development projects will be related to both levels of analysis, that is, the organizational and the project level. As such, in the remainder of this chapter, we first ground the challenges of supplier involvement in NPD theoretically by establishing a link to transaction cost economics. Second, we specifically address value appropriation as a key issue in the successful implementation of supplier involvement in NPD projects. Third, we highlight a number of project-level barriers to collaboration between buyer and supplier members of product development teams. The chapter concludes by outlining possible avenues for necessary further research.

## Maximizing Transaction Value

The importance of effective interorganizational governance structures has been addressed in economic theories, most notably transaction cost economics (TCE). This theory recommends structuring an institutional arrangement (e.g., the relationship between a buyer and a supplier who is involved in the buyer's product development activities) in a transaction cost economizing way (Williamson, 1985). Transaction costs can be broken down into search costs, contracting costs, monitoring costs, and enforcement costs. They are supposed to increase with an increasing level of relationship-specific investments, because such investments have to be protected against the hazards of opportunism; and the employment of safeguards against opportunistic behavior is associated with transaction costs. A safeguard suggested by TCE is strong formal commitment which is enforceable through legal institutions (Williamson, 1985). Informal commitment and social institutions, on the other hand, have essentially been neglected in the Western economies (Dyer, 1997). However, the prerequisites for the enforceability of formal commitments, in particular the ability to properly specify the buyer's and supplier's mutual obligations (Casson, 1997), are not given in complex R&D environments with intensive buyer–supplier collaboration. Specifying all contingencies of a R&D project, such as the required resources, the outcome in terms of technical solutions, quality or the cost of the product or service to be developed, at an early stage of supplier involvement is nearly impossible. Therefore, collaborative R&D projects ought to rely more heavily on informal commitment and appropriate self-enforcing mechanisms, such as trust (Choi, 1994; Morgan and Hunt, 1994).

As product development activities are concerned with creating value for customers in the form of new or enhanced products and services, buyers and suppliers working together in collaborative product development should not only be concerned with minimizing transaction costs, but also with maximizing transaction value (Dyer, 1997;



Zajac and Olsen, 1993). The level of relationship-specific investments and the degree and type of safeguard largely determine the incentive of the buyer and supplier to provide solutions, and put effort into the project beyond the contractual agreement (Dyer, 1997). Again, informal commitment seems to benefit the firm more than formal commitment.

### Issues of Value Appropriation

To satisfy their shareholders, firms have to extract the maximum value from buyer-supplier relationships (Porter, 1980) and protect themselves from supplier opportunism (Provan and Skinner, 1989; Stump and Heide, 1996). Despite recent developments in collaborative buyer-supplier relationships and supply chain integration, with profit maximization being a major goal of the individual firm, each firm linked with other firms in a relationship or supply chain has to strive for extracting the maximum value for itself. Therefore, in every buyer-supplier relationship where "pie expansion" (Jap, 1999) occurs through collaborative processes, such as joint product development, the appropriate sharing of the pie is an issue of major concern (Cox, 2001; Jap, 2001; Jeuland and Shugan, 1983). The notion of value appropriation in buyer-supplier relationships implies that (additional) value is created through inter-firm linkages and assumes that one or both parties seek advantage over the other by maximizing transaction value.

A comparison of two opposite supplier management approaches shows how tricky supplier involvement can be with respect to value appropriation issues. In *traditional production outsourcing*, the buyer company developed a new product largely in-house. Toward the end of the development process, detailed technical specifications for parts and components to be sourced from outside are the basis for a competitive bidding process, with the supplier offering the lowest price taking the contract (Bingham, 1989; Boutellier and Wagner, 2003; Clark and Fujimoto, 1991). By contrast, companies pursuing *supplier involvement* typically commit earlier in the development process to a specific supplier, however, regularly still after a competitive and negotiated price-finding process. Given the earlier stage in the development process, suppliers compete or negotiate for this collaboration under increased uncertainty. The result is a series of changes in cost/price of the supplier's component as the development project unfolds, so-called engineering change orders (Frey and Schlosser, 1993). This, in effect, creates a situation where pricing negotiations carry on for the duration of the product development project.

The "close but adversarial" model of buyer-supplier relationships, which could be observed in the US automotive industry, also underscores how the buying firm can take advantage of the supplier to reap short-term benefits and despite close relations strives to maximize period-by-period profit (Mudambi and Helper, 1998). Hence, this model underscores the contradiction between the cooperativeness that joint NPD projects require on the one hand and the firms' adversarial behavior on the other hand.

So far, only a few investigations have touched upon antecedents and outcomes of value appropriation issues and sharing processes in an NPD setting. Riordan and

Sappington (1989) investigated contradictions and effects of buyers' rent maximizing behavior in multistage defense procurement processes encompassing concept design, development, initial production, and full production. The buyer, that is, the Department of Defense (DoD), usually awards a development contract to one supplier, who also undertakes the initial production, and has the option to transfer the technology to a second source prior to the full production stage. Based on numerical simulation results the authors show that second sourcing has two negative consequences because second sourcing takes away rents from the developer (i.e., the first source supplier); the developer can anticipate lower rents in the production stage. First, the developer is less inclined to offer low R&D costs (negative R&D incentive effect). For the buyer, lower costs in the production stage through second source arrangement are offset by higher R&D costs in earlier stages. Second, the developer's R&D efforts will be reduced, resulting in longer development times and lower-quality products (Riordan and Sappington, 1989). In order to circumvent such negative influences, the authors' fundamental conclusion is that rent appropriation should be determined *ex ante*, that is, should be clarified at the development stage.

The focus of Jap's (2001) recent survey was on the impact of sharing principles (equity and equality principle) on the quality of buyer–supplier relationships in R&D settings. Although only a few proposed hypotheses could be supported, the findings nevertheless indicate that the sharing principle in complex collaboration contexts such as collaborative R&D has an impact on relationship quality. For example, the use of the equity principle has a negative impact on relationship quality when buyers and suppliers understand each other's transformation processes, that is, understand how the other party converts its resources to outputs. As a result, this research underscores the practical relevance of the contradiction between rent sharing (i.e., value appropriation) and relational interfirm processes, calling for a more fine-grained investigation and potential solutions for such contradictions.

Given that the "right" treatment of value appropriation issues seems to be a major challenge when NPD projects are carried out together with suppliers and that prior research (Jap, 2001; Riordan and Sappington, 1989) in this area is limited to the organizational level, the impact of value appropriation issues on collaborative processes on the project level deserves much more research attention.

### Issues of Project-level Collaboration

On the project level, successful supplier involvement requires collaboration between the buyer and the supplier members involved in the project. However, interorganizational product development projects are distinctly different from development projects without supplier involvement (so-called in-house projects). Below, we outline such principal differences and identify how these characteristics can set substantial barriers to collaboration in product development projects with supplier involvement.

First, the buyer and supplier members operate in at least two relevant capacities in the project, as members of the project (with its objectives) and as members of their respective organizations (with their objectives). This may result in role conflicts for the project participants from both firms (Levine and Moreland, 1990). For instance,



as their role as project members emphasizes open exchange of relevant information (Hoegl and Wagner, 2005), the role as members of their organizations may emphasize their respective organizations' desire to maximize their value appropriation from this business relationship. Hence, for example, the above-described process of "engineering change orders" and related price adjustments. Moreover, relevant elements of the two firms' organizational designs such as the goal and reward systems are likely to be oriented toward focusing all its members on organizational goals (e.g., rent appropriation) rather than supporting interorganizational collaboration.

Second, the project participants are also likely to differ with regard to their social identities based on their membership in two distinct organizations, the buyer and the supplier firm (Ashforth and Mael, 1989). Such differing social identities of project members, however, are likely to make project commitment and project collaboration more difficult to achieve (Hoegl et al., 2004). Also here, relevant elements of firms' organizational designs, such as its corporate culture, generally support the formation of individuals' social identities based on organizational membership in an effort to foster organizational integration (Lawrence and Lorsch, 1967). This, too, can pose barriers to collaboration in interorganizational NPD projects.

Third, in NPD projects with supplier involvement, sentiments of superiority of either partner may hamper strong buyer-supplier collaboration. For instance, buyer members may assume to have "the final say" as the "customer is king," or the members of a highly specialized and critical supplier may perceive themselves as "technically superior." Both cases provide barriers to collaboration similar to the well-known obstacles to cross-functional collaboration in in-house projects resulting from departmental rivalries, for example, between R&D and marketing (Brown and Eisenhardt, 1995; Denison et al., 1996; Keller, 2001), including the "not-invented-here syndrome" (Katz and Allen, 1988; Ragatz et al., 1997). Following social exchange theory (Homans, 1958), buyer and/or supplier members under the impression of superiority (technical or economic) may be taking less initiative in engaging in collaborative interaction with each other.

Fourth, the inclusion of supplier members in the buyer's NPD project is likely to inflate the project team in terms of head count. Team size, however, has been considered an important structural variable determining team processes – for example, team collaboration, social loafing, etc. – and subsequently team performance (Gladstein, 1984; Hackman, 1987; Steiner, 1966; Ziller, 1957). Research suggests that smaller teams provide for more direct and efficient intra-team communication (Bray et al., 1978), greater effort by all team members (i.e., reduced social loafing; Latané et al., 1979), and hence a better utilization of all team members' potential.

Fifth, supplier involvement is also likely to introduce a higher level of geographical dispersion relative to in-house projects. The geographical dispersion of team members, however, has potentially important implications for the collaborative working of teams (Brown and Eisenhardt, 1995). While evidence from a laboratory study (Schmidt et al., 2001) suggests that virtual teams may even produce superior performance on innovative tasks (e.g., new product development decision-making) when compared to teams with high geographical proximity, research by Hoegl and Proserpio (2004) suggests that geographical dispersion hinders important elements of teamwork such as communication, coordination, mutual support, and cohesion.

Taken together, these characteristics of NPD projects with supplier involvement highlight the challenges of creating high quality buyer–supplier collaboration and thus obtaining the intended benefits of an early supplier involvement strategy.

## Conclusions and Outlook

This chapter aimed at highlighting some critical difficulties at the organizational and the project level with regard to the involvement of supplier firms in buyers' product development. While such early supplier involvement has long been advocated to provide strategic advantages, this chapter aimed at offering possible reasons for why companies have found it difficult to reap the desired strategic potential.

However, the question of "What can be done?" remains, for both management scholars and practitioners. This chapter describes a decidedly unsatisfactory state of affairs, where we can offer explanations for why early supplier involvement in innovation can fail, even though it may make "strategic sense," but at present we can provide little on how to make it work. Nonetheless, we would like to give this much advice to practitioners.

First, this chapter should create awareness of the seriousness of issues in early supplier involvement, both at the organizational level and the project level. Hence, managers should take these discussions into consideration before moving forward with crafting and implementing early supplier involvement strategies. It would certainly make little sense abandoning a well-functioning system of in-house development and production, outsourcing for an early involvement strategy that does not offer good answers to the issues raised in this chapter.

Second, if pursuing an early supplier involvement strategy, this chapter does point to a number of project-level considerations that may offer advice. For instance, as with in-house development projects, the teams should be kept small (even though we are now adding supplier members), providing for (at least at times) physical proximity of all team members, creating a distinct project identity that can help integrate members from different organizations, and keeping questions of value appropriation outside the project team, but dealing with these issues perhaps at an elevated managerial level.

Third, value appropriation should be dealt with and settled *ex ante*. This last point, however, is where we see the greatest work ahead for management research.

Our discussions in this chapter underscore that, at present, management theory and research does not seem to offer pointed advice on this issue. Transaction cost economics tends to suggest *not* engaging in early supplier involvement, due to the inherent risks of opportunism and the high transaction costs associated with it. At the same time, the case for early supplier involvement in integrative product development is also convincing and has been around for a while. Moreover, companies are increasingly pursuing such avenues in search of competitive advantage.

This present state strongly emphasizes the pressing need for further research, and we see the following elements as important.

First, such further research would ideally address the cross-level nature of this phenomenon, where elements at the interorganizational relationship level,

the organizational level, the project level, and the individual level likely interact to affect the success of interorganizational innovation endeavors.

Second, future inquiries should also build on and expand the related work on product modularity. Rarely are product development projects "fully modular" or "fully integrative," with most projects ranging somewhere in between. Moreover, the process of defining a modular product architecture may well also be an interorganizational endeavor, likely posing similar issues.

Third, research on issues of value appropriation in interorganizational innovation will likely need to move beyond transaction cost considerations in explaining such aspects as value creation and trust.

Finally, future research should build on related work from various literatures on such topics as relationship marketing, interorganizational relationships, supplier management, product development, team management, and dispersed collaboration.

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## Learning to Compete

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